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December 16, 2011

Reference No. 6029-20

Mr. Regan S. Williams
State Project Coordinator
Ohio EPA - Division of Emergency & Remedial Response
2110 East Aurora Road
Twinsburg, Ohio 44087

Dear Mr. Williams:

Re: Revised Work Plan for Data Gathering
to Evaluate Feasibility and Assist in Possible Design of a
Limited Phytocontrol System for Groundwater Hydraulic Control
Summit National Superfund Site, Deerfield, Ohio

In its continuing commitment to the ongoing remediation at the Summit National Superfund Site (Site) in Deerfield, Ohio, the Summit National Facility Trust (SNFT) has researched alternative natural groundwater control technologies that could enhance the control of groundwater migration off of the Site. Based on this research, SNFT is investigating the feasibility of implementing a limited engineered phytocontrol system on the southeast portion of the Site to proactively help to reduce the amount of groundwater that may migrate off of the Site. This limited phytocontrol system would consist of planting of selected trees over a small portion of the southeastern area of the Site.

In order to design a suitable engineered phytocontrol system, SNFT will need to collect additional data specific to the design of phytocontrol systems. The attached *Work Plan for Data Gathering and Phytocontrol Services* (Work Plan) prepared by Applied Natural Sciences, Inc. of Hamilton, Ohio is submitted to the Ohio Environmental Protection Agency (OEPA) on behalf of SNFT. The Work Plan provides details of the additional data gathering required to support the conceptual design of a limited engineered phytocontrol system at the Site.

The SNFT is requesting approval from OEPA for the implementation of the attached data gathering Work Plan, and would be pleased to discuss the Work Plan and to clarify any questions that OEPA may have. Once the data have been obtained and evaluated, SNFT will determine if it is feasible to proceed with implementation of the limited engineered phytocontrol system at the Site, and if it determines such a system is feasible, would submit another work plan to OEPA for its review and approval for the implementation of the limited engineered phytocontrol system at the Site.

Should you have any questions or require additional information, please do not hesitate to contact the undersigned.

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Yours truly,

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Steve Whillier

SW/rrw/Will-071

Encl.

cc: Pablo Valentin, USEPA (2 hardcopies)
Robert Casselberry, SNFT
Jeff Sussman, SNFT
Joe Montello, SNFT
Douglas G. Haynam, Shumaker, Loop & Kendrick, LLP
Mike Mateyk, CRA (e-copy)
Nick Schapman, CRA (e-copy)



Applied Natural Sciences

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December 12, 2011

Summit National Facility Trust
c/o Republic Services, Inc.
190 Chadwick Drive
Aurora, OH 44202

Attn: Joe Montello, Trustee

Re: Work Plan for Data Gathering and Phytocontrol
Evaluation Services at Summit National Superfund
Site, Deerfield, OH

Dear Mr. Montello,

Applied Natural Sciences, Inc. (ANS) is pleased to submit this Work Plan (WP) to the Summit National Facility Trust (SNFT) for gathering data to support the conceptual design of an Engineered Phytocontrol system that would enhance the hydraulic groundwater control at the Summit National Superfund Site (Site) in Deerfield, Ohio. We look forward to assisting SNFT in proactively considering natural, reliable and cost effective techniques to manage site groundwater.

To assist ANS in the development of this WP, SNFT provided information regarding the existing groundwater collection system and historical groundwater quality data including the following documentation:

- Groundwater Extraction System Construction Details
- Soil Removal and Treatment Cross Sections
- Well Logs
- 2004 Effluent Reports
- 2004 Groundwater Extraction Status Report

Based on a review of these documents, as well as information obtained during a Site visit, ANS has concluded that Phytocontrol has the potential to be a viable and cost effective strategy for enhancing hydraulic control at the Site. Accordingly, this WP has been developed to define the steps necessary to verify the site-specific applicability of a **TreeMediation**[®] Program (that includes ANS' patented and proprietary Engineered Phytocontrol approach, the **TreeWell**[®] system) for limited phyto control of groundwater at the Site.



Site Background

The 11-acre Site is a former coal strip mine that contained a coal wash pond and a coal stockpile. From 1974 to 1978, the site was used as a waste storage/recycling/disposal facility and received liquid wastes such as oils, resins, paint and metal plating sludges, flammable solvents and chlorinated solvents. Two surface water ponds and an incinerator were also located onsite. The facility received liquid wastes which were stored in drums, an open pit, or in bulk tanks. Wastes were incinerated, buried, and disposed of on the soil. The groundwater, soil and surface water were subsequently impacted with volatile organic compounds (VOCs), phenols, phthalates, polychlorinated biphenyls (PCBs) and heavy metals including arsenic, chromium, and cadmium. Surface water runoff from the site eventually flows into the Berlin Lake Reservoir.

In 1991 a Consent Decree was entered into between SNFT, Ohio EPA, and USEPA. The SNFT was tasked with implementing remedial activities as described in the 1990 Record of Decision. Remedial activities at the Site included:

- Removal of waste
- Removal of impacted soils and surface water
- Regrading
- Installation of a permeable cap
- Installation of a media (French) drain for groundwater collection
- Installation of a groundwater treatment facility
- Operation, maintenance, and monitoring of installed systems

Remedial construction (RC) activities commenced at the Site on July 22, 1993, and were completed on August 4, 1995. Operation of the groundwater treatment system (GWTS) commenced on May 19, 1994 for Site dewatering activities (primarily the surface water ponds) required during RC. Operation of the groundwater extraction system (GWES) commenced on September 9, 1994, and was discontinued in August 2005 for the implementation of a pilot test shut down approved by Ohio EPA.

The groundwater collection trench (trench) was designed to collect water from the Water Table Unit (WTU – the uppermost water-bearing stratum) and was operated from September 1994 to August 2005. The trench was constructed along the southwest, south, and southeast perimeter of the Site. Flow in the WTU has been observed to be toward the southeast. The volume of groundwater extracted from the WTU and treated at the on-Site GWTS during system operation averaged less than 20 gpm from the pipe and media drain, which is less than the predicted flow rate for the pipe and media drain of 36 gpm. In addition, the concentration of contaminants in the recovered water was significantly lower than predicted. As discussed in the work plan for the pilot test for the shutdown, this was attributed to site conditions which limit the mobility of contaminants, primarily the low permeability and limited continuity of the shallow water bearing zones.

Since the shutdown of the groundwater remediation system in 2005, monitoring results for sentinel wells continue to show acceptable results indicating that continued shut down of the active recovery system is justified. Meanwhile, data for certain interior wells located upgradient continue to fluctuate.

If VOCs do appear above thresholds in the sentinel wells, this would trigger the implementation of the contingency actions previously approved by Ohio EPA.

As part of SNFT's commitment to continue active management of the Site, SNFT is evaluating the possibility of using Phytocontrol to proactively enhance the management of potentially impacted groundwater, particularly in the southeast part of the site where the water table is closest to the ground surface.

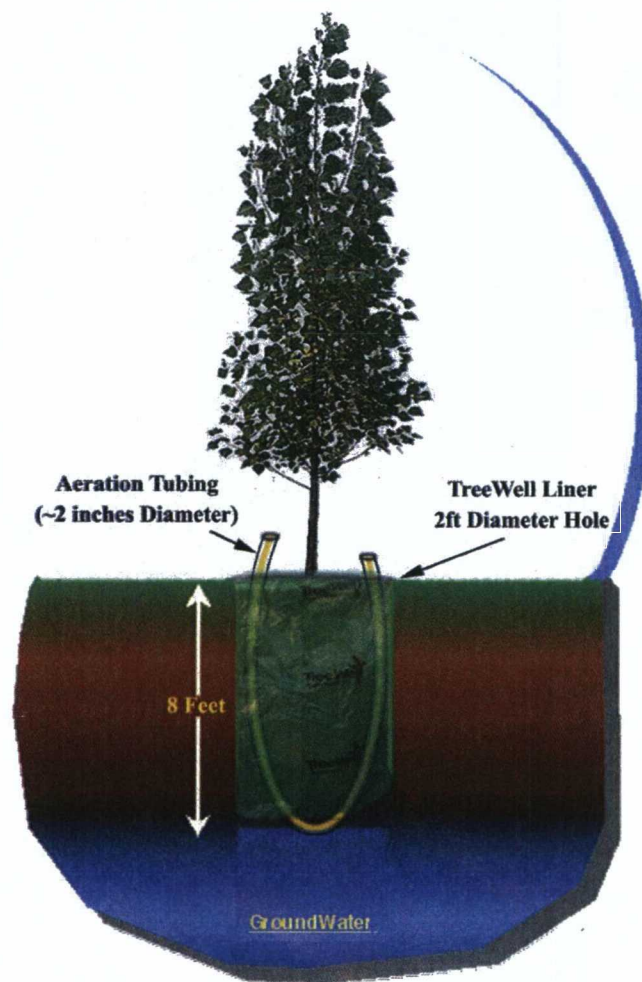
Figure 1. Summit National Superfund Site Map



Description of *TreeMediation*® Program

ANS offers innovative vegetative control approaches that are trademarked as *TreeMediation*® and *TreeWell*® terms. The *TreeMediation* program employs Phytocontrol processes including our patented and proprietary engineered *TreeWell* system (see Figure 2). The *TreeWell* system enhances the aggressive rooting ability of selected trees and other vegetation by engineering root growth to depths of 50 feet or more to clean up soil and groundwater, and to maintain control of groundwater migration. ANS has been very successful in using our *TreeMediation* program and patented *TreeWell* system to remediate VOCs, Metals, and SVOCs from soil and groundwater.

Figure 2. Example of the *TreeWell* System



Hydraulic Control

The *TreeMediation* program can address water (or leachate) disposal needs in a number of ways depending on site conditions and client requirements. Hydraulic control of deep groundwater can also be realized by our *TreeWell* system. In the northern Ohio area, selected species of vegetation can utilize over a million gallons of water per acre of vegetative canopy per year.

The *TreeMediation* program takes advantage of the high water-use capacity of selected trees and other vegetation to consume subsurface water and their extensive root systems to extract contaminants from the soil matrix and groundwater. Our Engineered Phytocontrol systems, such as the *TreeWell* system, differ from traditional Phytocontrol approaches in their capacity to overcome issues to deep rooting such as unfavorable soil conditions or complex stratigraphies. By “engineering” the growth of roots, trees can be made to:

- reliably reach the groundwater to depths of 50 feet or more, and
- direct the root growth to a particular horizon in the aquifer of interest while excluding other water sources.

The primary means of realizing these goals is by utilizing the *TreeWell* system in which a *TreeWell Root_Sleeve*[™] liner is installed to that targeted depth. This liner restricts lateral root growth and promotes vertical rooting development, allowing the roots to readily grow to the targeted depth in search of water.

Phytocontrol Applicability and Conceptual Approach

During the most recent years in which the on-Site groundwater treatment system was operational (2003-2005), an average of about 840,000 gallons of groundwater per month were extracted and treated. This equates to approximately 10 million gallons per year. In this same period, annual rainfall in Northeastern Ohio was about 5 to 10 inches above normal. Annual rainfall over the last two years (2009-2010) has been closer to normal.

As would be expected, water level elevations in the WTU (the uppermost aquifer) are observed to fluctuate in response to precipitation. Increased groundwater elevation observed in the southeastern portion of the Site are likely due to the high precipitation rate as well as the fact that groundwater has not been actively removed from the collection trench since 2005.

Purge data from certain monitoring wells in the southeast part of the site suggest a lower recharge rate. This limited flow condition supports the applicability of Phytocontrol as a means of reducing the potential for the off-Site migration of impacted groundwater in the WTU. A properly designed *TreeMediation* program has the potential to focus on areas with higher VOC impact to reduce the potential for off-Site migration.

The purpose of the investigations proposed in this WP is to collect data required to develop a conceptual *TreeMediation* program design that will likely include a combination of Engineered and Conventional Phytocontrol systems. The goal of the Phytocontrol will be to target impacted zones of the WTU, mainly in the southeast part of the site, in order to have the greatest possible impact on groundwater flowing toward the Site boundary in that area.

TreeMediation Program Feasibility Assessment

The Site information available to date support the successful implementation of a number of *TreeMediation* programs, including the *TreeWell* system. However, the existing data were collected with the goal of traditional groundwater collection and treatment technology and, while thorough for those purposes, do not provide the complete picture required for design of a Phytocontrol system. In order to design specific *TreeMediation* programs, ANS will need to conduct a Site investigation to develop an understanding of the soil profile in selected areas and collect soil and groundwater samples from these areas for analysis of agronomic parameters. Soil and groundwater samples will be analyzed for agronomic parameters that should fill remaining data gaps with respect to agronomic understanding of site conditions. Soil sampling will be conducted with the use of a Geo-Probe[®] type direct push sampler. Several soil samples will be collected from each sample location to characterize observed soil horizon/lithologic units. Typically, agronomic soil samples are collected in order to characterize each 2-feet of depth in each boring at a minimum.

Soils removed from the borings that are not used for agronomic analysis will be returned to the borings. If additional backfill is required, borings will be filled to the surface with cement/bentonite or bentonite grout.



All soil samples will be submitted to an agricultural analytical laboratory for analysis of the following agronomic parameters.

Test Parameters for Soil Samples

Organic matter	Phosphorus	Exchangeable Potassium
Magnesium	Calcium	Sodium
Soil pH	Buffer pH	Aluminum
CEC	%Base Saturation	Sulfur
Nitrate-nitrogen	Zinc	Manganese
Iron	Copper	Boron
Chloride	Ammonium	

If soil texture is not defined in the field through observation, then soil samples will be analyzed in the laboratory for soil texture (% sand, % silt and % clay).

Groundwater samples will also to be collected and submitted to an agricultural laboratory to be analyzed for agronomic parameters. Water samples will be collected from existing WTU wells and/or soil boring locations for the following parameters:

Test Parameters for Groundwater Samples

Nitrate-nitrogen	Zinc	Iron
Sulfate-Sulfur	Sulfate	Copper
Potassium,	Magnesium	SAR
Calcium	Boron	pH
Carbonate	Sodium	Alkalinity
Bicarbonate	Total Dissolved Solids	Electrical Conductivity
Total Hardness		

These additional agronomic data will help to develop a Phytocontrol design for optimal vegetative growth response and remedial effect.

Scope of Work

- Prepare a site specific health and safety plan for implementation of the investigative activities
- Install approximately six Geo-Probe® type soil borings between monitoring well MW-108 and the French drain and the sentinel wells to collect samples from vertical intervals as defined by observed soil horizons and water-bearing strata. Borings will be drilled to depths at which saturated conditions are encountered. Depending on location, saturated conditions are expected to be encountered at depths ranging from approximately 5 to 15 feet below the ground surface. Samples will be analyzed in a laboratory for agronomic parameters and soil physical properties. The data will be interpreted in order to develop the specific techniques that will be utilized to install *TreeWell* units. Excess soil cuttings will be returned to the boring.
- Collect groundwater samples from existing WTU monitoring wells MW-11, MW-107, MW-108, and MW-111 to be analyzed for agronomic chemical parameters.
- Prepare a *TreeMediation* design and implementation work plan based on the results of the agronomic investigation that will include:
 - Results of investigative activities to determine agronomic parameters
 - **Vegetation** – Typically Hybrid Poplars (*Populus*) and Hybrid Willows (*Salix*) trees would be the first species evaluated for application at the Site. Site conditions may require the consideration of other species.
 - **Installation Layout** – The specific location(s) and row spacings of the system(s) will be developed. The location(s) will ideally occur between monitoring well MW-108 and the French drain and/or the sentinel wells. The number of vegetative units will depend on accessibility, rainfall, soil type, species selected, and target water consumption rates.
 - **Soil Amendments** - Existing site environmental and general chemistry data will be evaluated to identify soil amendments necessary to optimize vegetative establishment and growth.
 - **Phyto Control Design Report** – a design report/work plan for implementation of a limited phyto control program will be prepared and submitted to Ohio EPA for approval.

Schedule

ANS will proceed with this evaluation upon receipt of Ohio EPA's approval of this work plan. The field work is anticipated to take one week to complete. The Phyto Control Design Report will be submitted to Ohio EPA approximately eight weeks after all field and analytical data has been received.


Qualifications

Applied Natural Sciences, Incorporated was founded in 1993 as a firm specializing in the application of natural processes to environmental cleanup issues. Applied Natural Sciences often realizes unique, cost effective, alternatives in resolving environmental problems through our understanding of the agricultural sciences. The rapidly developing national recognition of our one-of-a-kind and patented *TreeMediation*® programs and *TreeWell*® systems and over 22 years of field experience with multiple sites nationally and internationally has established Applied Natural Sciences as the leader in the engineering and implementation of vegetative remedial programs for soil and groundwater problems.

Applied Natural Sciences has developed a network of professionals with expertise in a variety of disciplines. In addition, ANS also partners with other firms to provide services related to regulatory consultation, environmental assessment and remediation.

Based upon information provided to this point, there appear to be no known conditions that would prevent the successful application of an Engineered Phytocontrol program at this site. We very much appreciate the opportunity to submit this work plan to you. Please feel free to contact Dr. Ken Richards at 734.323.4507 or myself at 513.895.6061 should you require clarification or additional information on any aspect of this work plan.

Sincerely,
Applied Natural Sciences, Inc.



Edward G. Gatliff, Ph.D.
President

Cc: Robert Casselberry, The Dow Chemical Company (e-copy)
Jeff Sussman, The Goodyear Tire & Rubber Company (e-copy)
Steve Whillier, CRA (e-copy)